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Winter Moose Surveys of the Omineca, Nation, and Ospika River Drainages, 1999

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1.0 INTRODUCTION

Winter range is a primary limiting factor for most ungulate populations in BC. Moose *(Alces alces)* distribution is strongly influenced by winter range conditions, particularly snow depth, forage availability, and the presence of tall, closed canopy conifer stands for shelter (Peek 1997). In mountainous areas animals move down slope as increasing snow depths (e.g., >70-80 cm) restrict mobility and forage availability (Hatler 1989, RIC 1997). Consequently, in the Williston Reservoir watershed, the greatest winter concentrations of moose occur along the major rivers and their adjacent low-elevation, warm aspect hillsides in the Parsnip and Finlay River drainages, and in isolated pockets on the north side of the reservoir's Peace Reach (Davidson and Dawson 1990). Shrub-dominated wetlands in the Sub-boreal Spruce (SBS) and Boreal White and Black Spruce (BWBS) biogeoclimatic zones provide important low elevation habitats that are heavily used by moose in the winter (MacKinnon et al. 1990). These zones were particularly impacted by the creation of the Williston Reservoir in the late 1960s, which flooded much of the highest capability moose winter range within the watershed (BC Environment 1989, Hatler 1989). Moose inventories and site enhancements have been identified as priority compensation activities (Hatler 1989, Schick and Ovaska 1996). Moose forage enhancement projects, including prescribed burning and manual thinning, have been conducted by the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP) at locations throughout the watershed, including manual thinning of mature willow and willow thickets at 6 sites on the Omineca River floodplain (Hengeveld 1998).

The PWFWCP conducted aerial inventories of moose congregated along the Omineca, Nation, and Ospika rivers in February 1999, to determine the distribution and demographics of moose wintering along these major rivers. The results of these surveys will aid wildlife managers in determining appropriate moose harvest levels and may identify other potential management needs (e.g., access management). These surveys will also help to identify important habitats and areas of concentration that may be suitable for protection and/or habitat enhancement projects.

This report documents the results of surveys conducted along riparian habitats adjacent to the Omineca, Nation and Ospika Rivers in February 1999.

2.0 SURVEY AREA

The Omineca, Nation and Ospika Rivers are 3 major watercourses that flow directly into the Williston Reservoir (Figure 1). The Omineca River flows eastward through the south end of the Omineca Mountains to the Williston Reservoir's Omineca Arm. The lower valley bottoms of the Omineca River drainage lie within the dry-cool Boreal White and Black Spruce biogeoclimatic subzone (BWBSdkl; MacKinnon et al. 1990). This lowland to montane subzone is climatically dry with an extensive fire history, and provides some of the best remaining moose winter habitat in the northern portion of the watershed. Mean annual snowfall in this subzone is 180 cm (MacKinnon et al. 1990), with maximum accumulated snow depths generally less than 60 cm (Lower Germansen snow station; BC Environment 2000). A snow depth survey conducted throughout the Williston Reservoir watershed in 1990 identified low snow depths along the Omineca River (20-80 cm, 700-800 m elevation (Martin 1994). The surveyed portion of this river drainage extended from Ogden Creek (approximately 800 m in elevation) to the Omineca Arm (672 m) (Figure 2). The Omineca River census area was divided into 3 survey units: Upper (Ogden Creek to Nina Creek), Middle (Nina Creek to tributary creek west of Blue Lake), and Lower (tributary creek west of Blue Lake to Omineca Arm). In the Upper and Middle survey units the river meanders extensively within the wide river floodplain; the floodplain is slightly more restricted downstream of Discovery Creek. The Lower survey unit is characterized by a more confined and linear watercourse, with forested upland slopes in close proximity to the main water channel.

The Nation River, situated south of the Omineca River and at the northern edge of the Interior Plateau, drains the Nation Lakes (868 m) as it also flows from the west to the Williston Reservoir. The Nation River drainage lies predominantly in the Mossvale moist-cool SBS subzone (SBSmk1; DeLong et al. 1993), but ultimately flows through the wet-cool (SBSwk2) and Williston moist-cool (SBSmk2) SBS subzones before reaching the Nation Arm of the Williston Reservoir (MacKinnon et al. 1990). Mean annual snowfall is about 310 cm in the SBSmkl and 1,075 cm in the SBSwk2 (DeLong et al. 1993, MacKinnon et al. 1990). Moderate to high snow depths have been identified along the Nation River at Philip Creek, Rainbow Creek, and Chuchi Lake (60-100cm, 900 m elevation) (PWFWCP, data on file). The entire length of the Nation River was surveyed, as were a couple of logged areas that abutted the river downstream of the Philip Creek confluence (Figure 3).

Figure 1. The Omineca, Nation, and Ospika River drainages within the Williston Reservoir watershed, north-central BC.

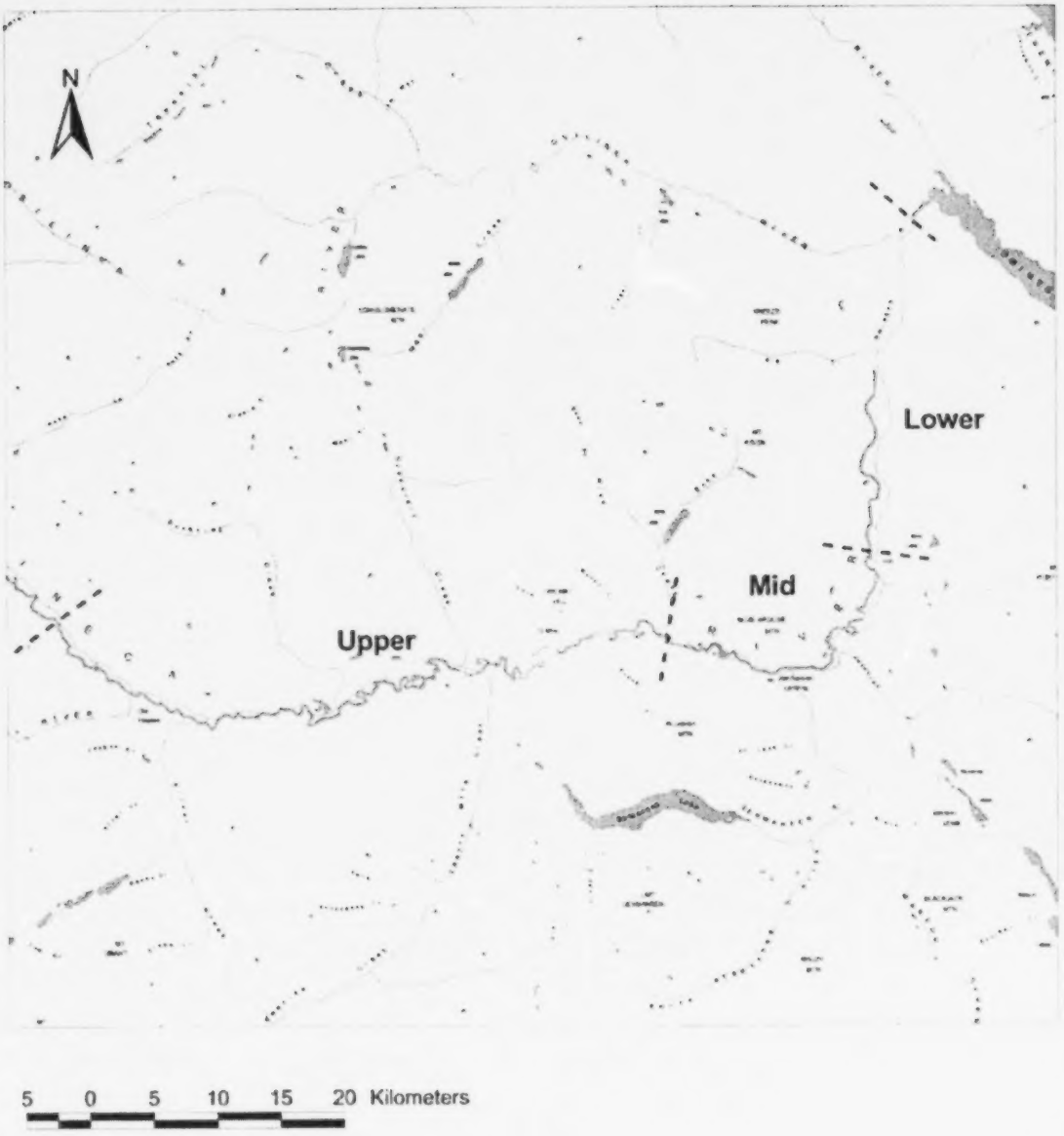

Figure 2. The Omineca River drainage winter moose survey units, February 1999: Upper (Ogden Creek to Nina Creek), Mid (Nina Creek to the tributary creek west of Blue Lake), and Lower (downstream from the creek to Omineca Arm).

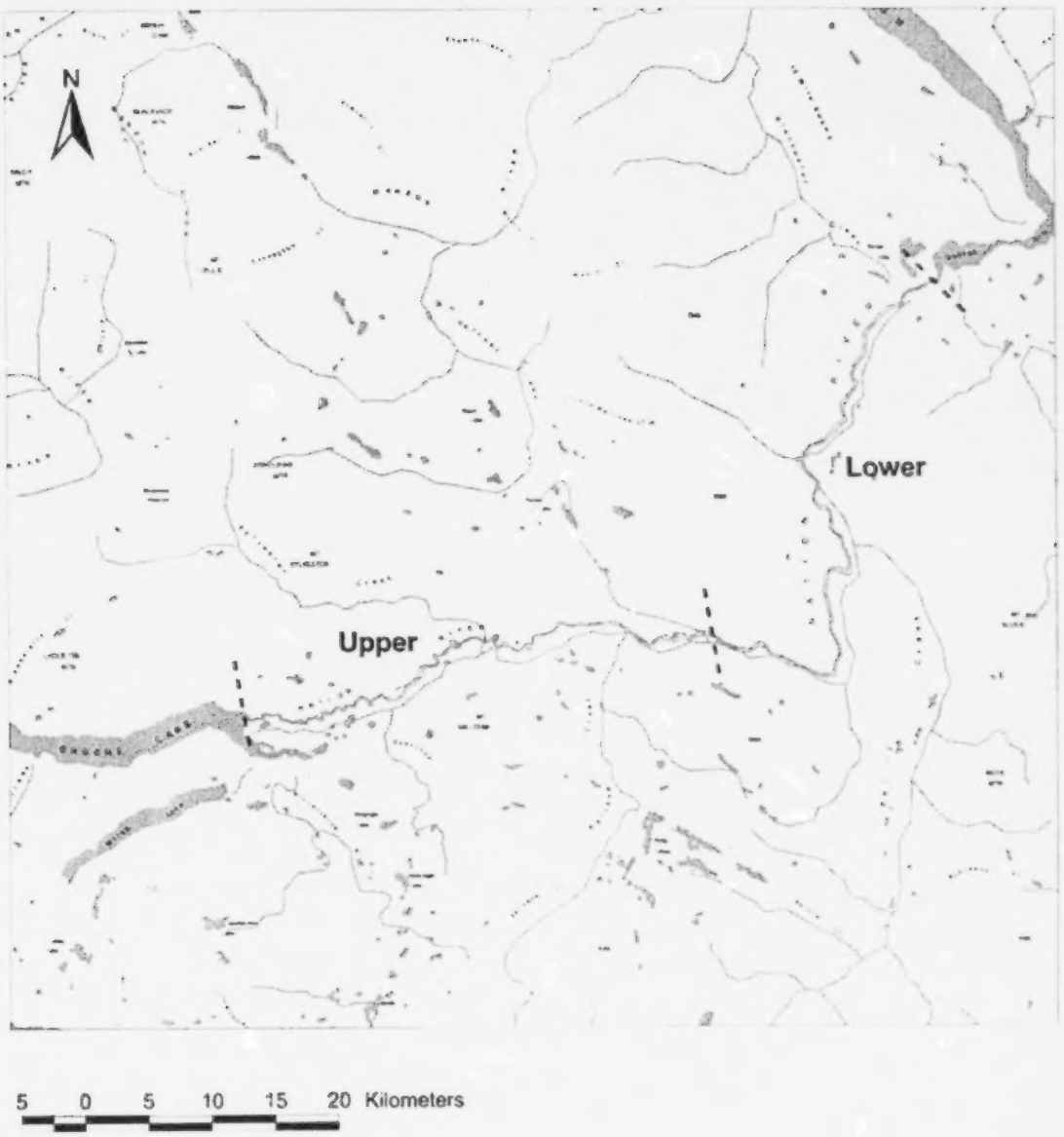

Figure 3. The Nation River drainage winter moose survey units, February 1999: Upper (Chuchi Lake to South Munro Creek area) and Lower (downstream from South Munro Creek to Nation Arm).

The Nation River is located within a relatively confined river drainage and is consequently less sinuous than the Omineca River; its adjacent slopes are also steeper and generally forested to the river bank. A wider floodplain area only occurs along the upper portion of the river, toward Chuchi Lake. The Nation River census area was divided into 2 survey units: Upper (Chuchi Lake to South Munro Creek area) and Lower (downstream from South Munro Creek area to Nation Arm).

The Ospika River is situated on the east side of the reservoir, north of the Peace Arm, and flows from the northeast down into the Ospika Arm (Finlay Reach, Williston Reservoir). The surveyed area of the Ospika River drainage lies within the SBSmk2 (MacKinnon et al 1990). Mean annual snowfall in this subzone is 335 cm (MacKinnon et al 1990), with annual snow accumulations for the survey area reaching 100 cm (Ospika Lower snow survey station, winter 1998-1999; PWFWCP, data on file). Moderate snow depths have been identified along the Ospika Arm (60-80 cm, 700-800 m elevation) (Martin 1994). The Ospika census area included the south-facing sidehill along the north shore of the Ospika Arm (Ospika Sidehill) and the Ospika River drainage proper from Balden Creek to the reservoir (Figure 4). The lower portion of the river meanders across the relatively broad floodplain; the river becomes more restricted upstream of the chasm. Deciduous and mixedwood forest stands and burned habitats are present in the uplands and along the Ospika Sidehill.

3.0 METHODS.

Surveys were conducted using a Bell 206 helicopter, flying at approximately 30 to 50 m above ground level, and a four-person crew (including the pilot). The navigator searched for, counted, and classified animals, and recorded location co-ordinates for each group of animals; co-ordinates were identified using the helicopter's on-board Global Positioning System (GPS) unit. The rear left seat observer recorded species, group number and size, and composition of animals observed. The rear right seat observer recorded location characteristics of animal locations (habitat type, slope, and aspect), and took photographs. The two rear seat observers also searched for and classified animals.

The survey flight line was concentrated on riparian and open valley bottom habitats along or adjacent to the river courses. At the Ospika Sidehill, some upland slopes were surveyed so parallel contour lines (800 m and 1,100 m elevations approximately) were flown to cover the area. Survey methodology followed the Resource Inventory Committee

Figure 4. The Ospika River drainage winter moose survey units, February 1999: River (from Ospika Arm to Balden Creek) and Sidehill (north side of Ospika Arm, between Ospika River and Ospika Camp).

(RIC) standards for Encounter Transects, a technique recommended for obtaining general distribution and population structure data in areas where visibility is good (e.g., open deciduous areas; RIC 1997). Moose were categorized to a Level 2 classification (RIC 1997), identifying bulls, calves, and cows based on body size and disparate characteristics. In the absence of antlers, cows were distinguished from bulls based on the presence of the white vulval patch and, secondarily, by the presence of a small sized bell and lighter snout colouration. Where multiple animals were located within close proximity (e.g., 100-300 m apart), only one group and location coordinate was recorded. For some groups, more than one habitat type was noted, (i.e., in some cases individuals within a group were observed using different habitat types). Flight lines and group locations were also recorded digitally using a Trimble XLR Pro GPS system.

Following the survey, flight lines were digitally overlaid onto 1:50,000 scale shaded relief maps to assist in determining survey area coverage and the distribution of moose locations in each river drainage. After delineating the survey areas on the maps, area and distance (drainage and river) calculations were determined using a planimeter and hand-wheel, respectively. Area and distance measurements are considered accurate to $\pm$ 0.5 km^2 and 0.5 km. Maps that were produced are stored at the PWFWCP office for future reference.

4.0 RESULTS

Surveys of the Omineca, Nation and Ospika River drainages were conducted between 24 and 26 February, 1999[1]. Survey conditions were good (Appendix A), as was observer visibility. Since these surveys were intended to obtain moose composition and distribution information, rather than a total count of the populations inhabiting these drainages, the moose numbers presented here do not fully reflect their wintering populations. This was evident as 2 radio-collared moose within the Omineca River drainage were not observed during our survey, as they were using conifer forests outside the census area[2].

[1] In order to complete the surveys in the most cost effective manner with other PWFWCP activities, these surveys were conducted in conjunction with a caribou survey of the Wolverine Mountain Range (Hengeveld and Wood 2000).
[2] Two GPS radio-collared moose were present in the Omineca River drainage at the time of the survey (Doug Heard, Ministry of Environment, Lands and Parks, Prince George, personal communication) but were determined to be outside the survey area; locations for the survey time period were downloaded from the GPS collars and mapped.

In total, 572 moose were observed within the 3 survey drainages. The Omineca River census area accounted for 86% (492) of the animals, with considerably fewer moose observed in the Nation (65) and Ospika (15) River drainages (Table 1; Appendix B).

The total survey area for all three drainages combined was 116.2 km^2, with survey units ranging in size from 4.0 km^2 (Ospika Sidehill) to 45.8 km^2 (Upper Omineca) (Table 2). The greatest number and the highest density of moose occurred in the Upper Omineca survey unit (Table 2). This survey unit also had the highest river meander index (a measure of river sinuosity and a reflection of the extent of riparian habitat present in the unit).

Most of the moose observed during the surveys were associated with willow-shrub (68%) and open (15%) habitats (Table 3). Moose observed in the Ospika survey area were primarily located in deciduous and mixedwood forested habitats.

4.1 Omineca River

Along the Omineca River, 372 (119 groups) and 120 (41 groups) moose were observed in the Upper and Middle census units respectively (Table 1). No moose were observed in the Lower census unit, however, 2 sets of moose tracks and a bed were noted. Moose distribution was concentrated between Silver Creek and Jackfish Creek (453 animals). Between Silver and Discovery Creeks, moose (207) were aggregated in several riparian oxbow areas, whereas they were more or less evenly distributed between Discovery and Nina Creeks (154) and Nina and Jackfish Creeks (92). The moose observed were predominantly located in riparian willow-shrub habitats, with fewer moose observed downstream of Jackfish Creek, beyond which the river becomes more linear and riparian shrub habitat is reduced.

The bull:cow ratio for the Upper and Middle census units combined was 27:100. The calf:cow ratio for the same area was 35:100. Three sets of twins were counted. Five moose kills were observed: 3 in the Upper census unit, 1 in the Middle unit, and 1 in the Lower unit (Appendix A). Wolf tracks were observed in all three portions of the surveyed area.

Moose use of manually slashed areas along the Omineca River (see Hengeveld 1998) was also noted. Moose were observed at sites 12W and 18, and adjacent to sites 4 and 11. Although no animals were observed, tracks were observed at sites 1, 12, 13S, and 18. No moose sign was evident at sites 13N and 14.

Table 1. Abundance, distribution and composition results from winter moose surveys conducted in the Omineca, Nation, and Ospika River drainages, 24-26 February, 1999.

Drainage & Survey Unit	No. of Groups	Total	Composition[a]						Ratios		Density
			Bull	Cow	UA	Yrlg	Calf	Uncl.	Bull:Cow	Calf:Cow	
Omineca River											
Lower	0	0									0 /km^2
Middle	41	120	8	74	10	2	25	1	11:100	34:100	7.1 /km^2
Upper	119	372	65	194	32	13	68		34:100	35:100	8.1 /km^2
Total	**160**	**492**	**73**	**268**	**42**	**15**	**93**	**1**	**27:100**	**35:100**	**6.9 /km^2**
Nation River											
Lower	7	11	3	6			2		50:100	33:100	0.9 /km^2
Upper	22	54	13	30	2		9		43:100	30:100	3.4 /km^2
Total	**29**	**65**	**16**	**36**	**2**		**11**		**44:100**	**31:100**	**2.3 /km^2**
Ospika River											
River	1	1	1								0.1 /km^2
Sidehill	6	14	3	7	2		2		43:100	29:100	3.5 /km^2
Total	**7**	**15**	**4**	**7**	**2**		**2**		**57:100**	**29:100**	**0.9 /km^2**
Total	**196**	**572**	**93**	**311**	**46**	**15**	**106**	**1**			

[a] Composition abbreviations: UA (unclassified adult), Yrlg (yearling, 22 months old), Calf (10 months old), Uncl, (age and sex unknown).

Table 2. Survey unit statistics for winter moose surveys conducted in the Omineca, Nation, and Ospika River drainages, 24-26 February, 1999.

Drainage &	Linear Distance (km)		Meander	Survey Area	Survey	Survey Intensity	Moose	
Survey Unit	Drainage	River	Index[a]	(km^2)	Time (hrs)[b]	(min/km^2)	Total	Density
Omineca River								
Lower	32.5	34.0	1.05	8.4			0	
Middle	23.7	29.5	1.24	16.9			120	7.1/km^2
Upper	47.5	71.0	1.49	45.8			372	8.1/km^2
Subtotal	**103.7**	**134.5**		**71.1**	7.4	6.2	**492**	**6.9/km^2**
Nation River								
Lower	47.3	50.7	1.07	12.1			11	0.9/km^2
Upper	40.8	48.2	1.18	16.0			54	3.4/km^2
Subtotal	**88.1**	**98.9**		**28.1**	2.6	5.4	**65**	**2.3/km^2**
Ospika River								
River	28.9	33.5	1.16	13.0			1	0.1/km^2
Sidehill	9.0	n/a		4.0			14	3.5/km^2
Subtotal	**37.9**	**33.5**		**17.0**	1.1	3.8	15	0.9/km^2
TOTAL	**229.7**	**266.9**		**116.2**	11.1		**572**	

[a] Survey times for the individual census units were not available, thus only a total search time is reported for each drainage. Times do not include ferry or re-fueling times.

[b] The meander index is an indices of river sinuosity and therefore the extent of riparian habitat. Values are the product of the linear river distance divided by the linear drainage distance.

Table 3. Moose distribution and abundance (percentage of total) by habitat type[a], for winter surveys conducted in the Omineca, Nation, and Ospika River drainages, 24-26 February 1999.

Drainage	Forested				Shrub	Open	Total
	Conifer	Deciduous	Mixed	Sb			
Omineca River	38(8)	8(2)	23(5)	7(1)	346 (70)	70(14)	492
Nation River	2(3)	3(5)	4(6)	2(3)	40 (62)	14(22)	65
Ospika River		5(33)	9(60)		1(7)		15
TOTAL	40(7)	16(3)	36(6)	9(2)	387 (68)	84(15)	572

[a] Forested habitats: conifer (pine, hybrid spruce); deciduous (trembling aspen, black cottonwood); mixed (conifer and deciduous), Sb (black spruce forested wetland). Shrub habitats: willow, red-osier dogwood, and alder. Open habitats: non-vegetated areas (e.g., gravel bars); ice (frozen and snow covered portions of rivers and lakes).

4.2 Nation River

Sixty-five (65) moose in 29 groups were found sporadically distributed between Philip Creek and Chuchi Lake along the Nation River (Table 1). Over 60% of the moose observed were located along the river between Rainbow and Suschona Creeks, with the largest moose concentrations (13 and 14 animals, respectively) at the confluence of these tributaries with the Nation River. The moose observed were primarily in the Upper survey unit, where the river was situated on a broader floodplain and riparian shrub habitats were more prevalent.

The combined bull:cow ratio for the Upper and Lower census units was 44:100 (Table 1). The calf:cow ratio for the same area was 31:100. One moose kill was observed on the river, near South Munro Creek (Appendix A). Wolf tracks were observed upstream of Philip Creek (near Group #1) and downstream of Chuchi Lake (near Group #29). Both fresh and old moose and wolf tracks were observed on the river between the Nation Arm and Philip Creek, as well as in some adjacent areas (e.g., low elevation forest clearcuts). A fresh set of wolverine tracks also crossed the river.

4.3 Ospika River

Very few moose were found in the Ospika River drainage; 14 of the 15 animals located were on the Ospika Sidehill, the south-facing slopes between Ospika Camp and the Ospika River (Table 1). The lone bull moose located along the river was less than 1 km from the Ospika Arm. Both fresh and old moose tracks were observed along the river and 1 moose kill was found (Appendix B).

5.0 DISCUSSION

5.1 Distribution and Abundance

The number of moose present in the Williston Reservoir watershed may be roughly estimated at 5300 to 10,400 animals, with 547 to 1,581 of those in the southwest (includes portions of the Nation, Manson, Omineca, and Osilinka River drainages; Demarchi 2000) and 2,868 to 5,755 animals in the north (includes portions of the Mesilinka, Ingenika, Finlay, and Ospika River drainages; Demarchi 2000) (Table 4).

Table 4. Moose population demographics from other winter surveys conducted in the Williston Reservoir watershed.

Location	Year	n	Population Estimate	Density (per km^2)	Ratios		Source
					Bull:Cow	Calf:Cow	
Southern (Williston)							
Parsnip drainage	1998	160	800-2000	0.6	112:100	23:100	Heard et al. 1999
Mackenzie - Omineca Arm (WMU 7-29, 7-30)	1989	449			59:100	30:100	Hatler 1989
Nation - Omineca - Osilinka drainages (WMU 7-28, 7-29, 7-38)	2000	112	547-1581	0.3	69:100	35:100	Demarchi 2000
Peace Arm			1,100				Davidson and Dawson 1990
Omineca - Manson - Germansen drainages	1998	315					Pacific Slope Consulting 1999
Omineca - Manson - Germansen drainages	1998	256					Pacific Slope Consulting 1999
Northern (Williston)							
Finlay drainage (WMU 7-40, 7-41)	1998	271			77:100	28:100	Terry and Handler 1998
Ingenika - Finlay - Ospika drainages (WMU 7-37 -7-41)	1990	423			139:100	42:100	Hatler 1990
Mesilinka - Ingenika - Finlay - Akie - Ospika drainages (WMU 7-37 - 7-41)	2000	313	2868-5755	0.6	49:100	18:100	Demarchi 2000
Osilinka - Mesilinka - Ingenika drainages	1998	269					Pacific Slope Consulting 1999
Ospika - Akie drainages	1998	244					Pacific Slope Consulting 1999
Ospika - Akie drainages	1998	286					Pacific Slope Consulting 1999

These figures provide some context for the nearly 500 moose counted during this survey in the Upper and Middle Omineca survey units combined. It is apparent that, in late winter, the Omineca River drainage accommodates a significant proportion of the moose present in the southwestern portion of the Williston Reservoir watershed. These moose were also highly concentrated, with notable densities of 8.1/km^2 and 7.1/km^2 observed in the Upper and Middle Omineca survey units, respectively. Moose densities in North America generally range from 0.1/km^2 to 0.5/km^2 in areas where their predators are not exploited (Timmerman and Buss 1997), although densities of 4.05/km^2 to 9.27/km^2 have been reported for ecological moose concentrations (i.e., those occurring in specific habitat types in specific seasons; Karns 1997). In the Williston Reservoir watershed, winter moose densities of 0.3/km^2 and 0.6/km^2 have been reported (Table 4).

A high number and density of moose in the Omineca River valley was not unexpected, as it typically has lower snow depths than the surrounding upland landscape and has extensive deciduous growth suitable for foraging moose. Physiographically, the river's sinuosity and broad floodplain make it more amenable to sustaining higher moose concentrations. A greater river meander index value suggests an increased potential for closer juxtaposition of adjacent suitable foraging habitat. Thus, a survey unit with a higher meander index value (reflecting a greater extent of riparian habitat present in the survey unit) may be more likely to have higher densities of moose. The prevalence of moose in riparian shrub habitats during the surveys, and the apparent scarcity of moose in those survey areas where these habitats were limited, is reasonable considering the value of such habitats to wintering moose (Peek 1997). However, because the survey design was biased toward riparian shrub habitats, no conclusions regarding habitat use patterns or preferences can be drawn from these data.

In the Lower Omineca and Lower Nation survey units, where each river is relatively narrow with steeper, forested banks, it is possible that moose may make more extensive use of upland deciduous areas and regenerating logged areas. Hatler (1989) reported that logged areas were the most intensively used winter moose habitats in the southern Williston Reservoir watershed, and noted that moose tracks were common in lower elevation logged areas and some slopes immediately adjacent to the Nation River.

The distribution and low numbers of moose observed in the lower Ospika drainage was similar to that reported by other surveyors (see Hatler 1990 and Pacific Slope Consulting 1999). Moose in this area were generally associated with deciduous stands and burned

habitats, (i.e., the south-facing slopes along the Ospika Arm), with observations of moose and tracks along the river suggesting the presence of low numbers of moose only.

The predominant use of forested habitats apparent in the surveyed portion of the Ospika drainage is not considered significant (and therefore may not be representative of the moose population in this drainage) because of the small sample size observed in this survey area. However, increased use of forested habitats by moose is typical in late winter, and may be due to unfavourable snow conditions, and/or reduced forage quality or availability in valley-bottom riparian habitats (Peek 1997). Deeper snow depths (>80 cm) in the upper portions of the valley (Martin 1994) and the resulting reduced forage availability may be limiting factors for moose in this area. By comparison, the lower Ospika River drainage was observed to have less extensive deciduous, valley-bottom habitat than the Upper survey units along the Omineca and Nation Rivers. Hatler (1990) noted that intensive use of logged areas in the southern Williston Reservoir watershed (includes the Omineca and Nation River drainages) contrasts with the higher use of burned habitats by moose in the northern portion of the watershed (includes the Ospika River drainage). Northern landscapes, however, are more remote and less intensively harvested than in the south, thereby allowing prescribed burns for wildlife range enhancement to be conducted (such as those conducted by the PWFWCP; see Wood et al. in prep) and more extensive wildfires to occur, especially at lower elevations.

5.2 Demographics

The average bull:cow ratio of 27 bulls per 100 cows along the Omineca River is within the lowest 25% of the ratios reported for 26 other moose surveys in northern BC (Hatter 1998, as cited by Demarchi 2000). The ratio of 44 bulls: 100 cows along the Nation River is more typical, but is below the threshold of 50 bulls: 100 cows proposed for moose management in northern BC (Hatter 1998). In comparison, bull:cow ratios reported for other winter moose surveys conducted in the Williston Reservoir watershed ranged from 49 to 139 bulls per 100 cows, with a ratio of 69:100 reported for the southwestern portion of the watershed (includes the lower Nation, Omineca, and Osilinka River drainages; Demarchi 2000) (Table 4). It is not clear whether the low number of bulls in the Omineca River drainage is suggestive of spatial segregation between bulls and cow/calf groups (e.g., distribution in upland areas versus valley-bottom habitats), or simply reflects a depressed bull count in the population. The uneven distribution of bulls between the Upper and Middle Omineca survey units may support the theory of some spatial segregation, or the remnant results of potentially higher hunting pressure on bulls

occurring in the Middle survey unit (the Upper survey unit is mainly limited to boat access only).

The calf:cow ratios for all 3 drainages (29 to 35 calves per 100 cows) indicate a healthy level of recruitment and over-winter survival (see Hatter 1998, Hatter and Bergerud 1991). The calf to cow ratios observed were comparable to those reported for other moose surveys conducted in the Williston Reservoir watershed (Table 4).

5.3 Potential for Enhancement

Areas with high moose concentrations (e.g., Upper and Middle Omineca River, Upper Nation River) may warrant forage enhancement activities in order to maintain their numbers. Also, if winter forage is limiting, forage enhancement activities conducted in the less populated areas may increase the distribution of moose (and therefore possibly the population) by providing alternative suitable foraging sites. Increased wildlife management attention may also have to be afforded to some of the key wintering areas.

6.0 ACKNOWLEDGEMENTS

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7.0 LITERATURE CITED

BC Environment. 1989. Finlay-Omineca Strategic Environmental Plan. Planning and Assessment Branch and Northern Region, BC Ministry of Environment, Prince George. 67 pp. plus appendices.

BC Environment. 2000. Snow Survey Bulletin. Victoria, BC: Ministry of Environment home page, http://www.elp.gov.bc.ca/wat/snow_bulletin/archive/1999/ (Version July 2000).

Davidson, P.W., and R. Dawson. 1990. Williston Wildlife Compensation Program Management Plan 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 5. Prince George, BC. 44pp.

DeLong, C., D. Tanner, and M.J. Jull. 1993. A field guide for site identification and interpretation for the southwest portion of the Prince George Forest Region. Ministry of Forests Land Management Handbook Number 24. Ministry of Forests, Prince George, BC. 290pp.

Demarchi, M.W. 2000. Moose inventory in and around the Tsay Keh Dene traditional territory, north-central British Columbia, February 2000. LGL Limited, Sidney, BC. 13pp plus appendices.

Hatler, D.F. 1989. Moose winter distribution and habitat use in the southern Williston Reservoir area, British Columbia, 1989. Peace/Williston Fish and Wildlife Compensation Program Report No. 1. 25pp plus appendices.

Hatler, D.F. 1990. Wildlife distribution and habitat use in the northern Williston Reservoir area, British Columbia, winter 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 3. 17pp plus appendices.

Hatter, I. 1998. Moose conservation and harvest management in central and northern British Columbia: Draft for stakeholder discussion. BC Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, BC. 47pp plus appendices.

Hatter, I. and W.A. Bergerud. 1991. Moose recruitment, adult mortality and rate of change. Alces 27:65-73.

Heard, D.C., K.L. Zimmerman, L.L. Yaremko, and G.S. Watts. 1999. Moose population estimate for the Parsnip River drainage, January 1998. Final report for Forest Renewal BC Project No. OP96004.

Hengeveld, P.E. 1998. Omineca River moose forage enhancement, 1992-1994. Peace/Williston Fish and Wildlife Compensation Program Report No. 132. 8pp plus appendices.

Hengeveld, P.E. and M.D. Wood. 2000. Wolverine caribou herd winter survey 1999. Peace/Williston Fish and Wildlife Compensation Program Report No. 231. 11pp plus appendices.

Karns, P.D. 1997. Population distribution, density and trends. *In:* Ecology and management of the North American moose. A.W. Franzmann and C.C. Schwartz (eds.). Wildlife Management Institute, Washington, D.C. Pp. 135-136.

MacKinnon, A., C. DeLong, and D. Meidinger. 1990. A field guide for identification and interpretation of ecosystems of the northwest portion of the Prince George Forest Region. Land Management Handbook Number 21. Ministry of Forests, Victoria, BC. 116pp.

Martin, T. 1994. Snow depth survey January - March 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 36. 7pp plus appendices.

Pacific Slope Consulting. 1999. Ecological factors affecting northern caribou in the Omineca Region, British Columbia: Year 1 (1998) inventory results. Prepared for Slocan Forest Products and Finlay Forest Industries, Mackenzie, BC by Pacific Slope Consulting, Victoria, BC. 13pp plus appendices.

Peek, J.M. 1997. Habitat relationships. *In:* Ecology and management of the North American moose. A.W. Franzmann and C.C. Schwartz (eds.). Wildlife Management Institute, Washington, D.C. Pp 351-376.

RIC (Resources Inventory Committee). 1997. Aerial based inventory techniques for selected ungulates. Version 1.1. Standardized inventory methodologies for components of British Columbia's biodiversity. Ministry of Environment, Lands and Parks, Victoria, BC.

Schick, Craig and Kristina Ovaska. 1996. Wildlife inventory plan Phase 1: Priorities for wildlife and habitat inventories in British Columbia. Ministry of Environment, Prince George. 57pp plus appendices.

Terry, E. and R. Handler. 1998. Aerial ungulate survey: Finlay River. Report prepared for the Ministry of Environment, Lands and Parks, Wildlife Branch, Prince George by Keystone Wildlife Research, Prince George, BC.

Timmerman, H.R. and M.E. Buss. 1997. Population and harvest management. *In:* Ecology and management of the North American moose. A.W. Franzmann and C.C. Schwartz (eds.). Wildlife Management Institute, Washington, D.C. 587pp.

Appendix A Survey details for the winter moose surveys of the Omineca, Nation, and Ospika River drainages, 1999.

Weather Conditions

Snow depths recorded on 26 and 27 February 1999 at the Upper Germansen (Station 4A05; 1500 m elevation) and Mackenzie (Station 4A19; 700 m) snow survey stations were 129 cm and 111 cm, 15 cm and 25 cm respectively above the long-term mean for those dates (BC Environment, 2000). While the surveyed portions of the Omineca and Ospika Rivers were frozen, the last ~7.5 km of the Nation River (from ~1 km upstream of the bridge at 60 km on the Thutade-Nation FSR, to the outlet at Chuchi Lake) was ice-free.

Weather conditions recorded during the winter moose inventory along the Omineca, Nation, and Ospika rivers, 24-26 February 1999.

Date	Time (hrs)	Survey Area	Temperature at Elevation	Wind Direction and Speed	Cloud Cover	Precip	Snow Cover
24 Feb	1324	Upper Omineca	-3 at 3200'	calm	100%	none	100%
25 Feb	0935	Middle Omineca	-8 at 3000'	calm	100%	none	100%
	1228	Middle Omineca	0 at 3000'	E, 2-5km/hr	>50%	light	100%
26 Feb	0851	Nation	-6 at 2350'	E, 6-12 km/hr	<50%	none	100%
	1245	Lower Omineca	-4 at 3000'	SE, 6-12 km/hr	<50%	none	100%
	1353	Ospika	-5 at 3500'	SE	<50%	none	100%

Search Intensity

Total helicopter time for the winter moose inventory along the Omineca, Nation, and Ospika rivers, 24-26 February 1999.

Survey Area	Date	Times (hrs)	Ferry Time[a]	Survey Time
Omineca			use decimal hrs	use decimal hrs
Old Hogem to Wendy Creek	24 February	1324-1538	2 hrs 26 min	2 hrs 14 min
Old Hogem to Wendy Creek, cont'd.	25 February	0935-1140	0 hrs 53 min	2 hrs 05 min
Wendy Creek to N Tacla Lk Res	25 February	1228-1426	0 hrs 08 min	1 hrs 58 min
N Tacla Lk Res to W.Reservoir	26 February	1245-1341	0 hrs 08 min	1 hrs 6 min
Total			3 hrs 35 min	7 hrs 23 min
Nation	26 February	0851-1124	0 hrs 30 min	2 hrs 33 min
Ospika	26 February	1353-1458	2 hrs 10 min	1 hrs 5 min
Total			6 hrs 15 min	11 hrs 1 min

[a] Ferry time includes travel to and from fuel caches, daily travel to and from Mackenzie, and final return by helicopter to Prince George.

APPENDIX B. Survey data for the winter moose surveys of the Omineca, Nation, and Ospika River drainages, February 1999.

Date	Group	UTM Easting	UTM Northing	UTM Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Ogden Creek to Nina Creek																		
24/Feb	1	341152	6185212	10	55	47.30	125	32.00	1						1			
24/Feb	2	341702	6184784	10	55	47.08	125	31.46	1							1		
24/Feb	3	343302	6183890	10	55	46.63	125	29.90	2					2				
24/Feb	4	344450	6183533	10	55	46.46	125	28.79	4							4		
24/Feb	5	345061	6182750	10	55	46.05	125	28.18	2	1				1				
24/Feb	6	345986	6182866	10	55	46.13	125	27.30	1							1		
24/Feb	7	347839	6181390	10	55	45.37	125	25.48	1					1				
24/Feb	8	348892	6180963	10	55	45.16	125	24.46	2	1				1				
24/Feb	9	348892	6180963	10	55	45.16	125	24.46	2						2			
24/Feb	10	349533	6181331	10	55	45.37	125	23.86	2	1				1				
24/Feb	11	349896	6181541	10	55	45.49	125	23.52	3	1				1	1			
24/Feb	12	349542	6181572	10	55	45.58	125	23.86	2						2			
24/Feb	13	350381	6181933	10	55	45.71	125	23.07	1					1				
24/Feb	14	350353	6180504	10	55	44.94	125	23.05	1							1		
24/Feb	15	350131	6181069	10	55	45.24	125	23.28	2	1				1				
24/Feb	16	350426	6181114	10	55	45.27	125	23.00	1					1				
24/Feb	17	351636	6180664	10	55	45.05	125	21.83	4					1		3		
24/Feb	18	351690	6181944	10	55	45.74	125	21.82	2	1				1				
24/Feb	19								1							1		coord. not available
24/Feb	20	351008	6181893	10	55	45.70	125	22.47	2	1				1				
24/Feb	21	351269	6181884	10	55	45.70	125	22.22	1					1				
24/Feb	22	352450	6181509	10	55	45.52	125	21.08	2						2			
24/Feb	23	352613	6181392	10	55	45.46	125	20.92	2	1				1				
24/Feb	24	354027	6182347	10	55	46.00	125	19.60	5	2				1	1	1		set of twin calves
24/Feb	25	353738	6182153	10	55	45.89	125	19.87	2	1				1				
24/Feb	26	355807	6182362	10	55	46.04	125	17.90	2				1	1				
24/Feb	27	355316	6182397	10	55	46.05	125	18.37	1					1				
24/Feb	28	355891	6182693	10	55	46.22	125	17.83	1							1		
24/Feb	29	356699	6182759	10	55	46.27	125	17.06	2						2			
24/Feb	30	356477	6182989	10	55	46.39	125	17.28	1							1		
24/Feb	31	358107	6182602	10	55	46.21	125	15.71	78	8			5	39	20	6		
24/Feb	32	358417	6183464	10	55	46.68	125	15.44	1					1				
24/Feb	33	359278	6182898	10	55	46.39	125	14.60	1					1				
24/Feb	34	359683	6183126	10	55	46.52	125	14.22	4						4			
24/Feb	35	360083	6182872	10	55	46.39	125	13.83	2				1	1				
24/Feb	36	360286	6183014	10	55	46.47	125	13.64	3		1			2				

APPENDIX B. Continued.

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification: Calf	Yearling: M	Yearling: F	Yearling: Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Ogden Creek to Nina Creek, continued.																		
24/Feb	37	360852	6183051	10	55	46.50	125	13.10	1					1				
24/Feb	38	360496	6182376	10	55	46.13	125	13.42	1							1		
24/Feb	39	359806	6182083	10	55	45.96	125	14.07	2							2		
24/Feb	40	361938	6183629	10	55	46.83	125	12.08	7					3	4			
24/Feb	41	362752	6184235	10	55	47.17	125	11.32	2					2				
24/Feb	42	362805	6183917	10	55	47.00	125	11.26	1							1		
24/Feb	43	362985	6183318	10	55	46.68	125	11.07	2	1				1				
24/Feb	44	363358	6183881	10	55	46.99	125	10.73	5			1		3	1			
25/Feb	45	363607	6183465	10	55	46.77	125	10.48	1					1				
25/Feb	46	363317	6183567	10	55	46.82	125	10.26	2	1				1				
25/Feb	47	363477	6184323	10	55	47.23	125	10.63	1					1				
25/Feb	48	363278	6184329	10	55	47.23	125	10.82	5	3				2				1 set of twins
25/Feb	49	363566	6184506	10	55	47.33	125	10.55	8	3				5				
25/Feb	50	363981	6184400	10	55	47.28	125	10.15	2	1				1				
25/Feb	51	364928	6183554	10	55	46.84	125	9.22	4	1				3				
25/Feb	52	364919	6184297	10	55	47.24	125	9.25	2	1				1				
25/Feb	53	365373	6184431	10	55	47.32	125	8.82	2					2				
25/Feb	54	365651	6184292	10	55	47.25	125	8.55	9	2				6	1			
25/Feb	55	365971	6184153	10	55	47.18	125	8.24	2	1				1				
25/Feb	56	366183	6185594	10	55	47.96	125	8.08	1						1			
25/Feb	57	366087	6185541	10	55	47.93	125	8.17	5			1		2	2			
25/Feb	58	366479	6185715	10	55	48.03	125	7.80	2						2			
25/Feb	59	366676	6185634	10	55	47.99	125	7.61	2	1				1				
25/Feb	60	367092	6185566	10	55	47.96	125	7.21	2					2				
25/Feb	61	367400	6185371	10	55	47.86	125	6.91	2	1				1				
25/Feb	62	368922	6184545	10	55	47.44	125	5.43	4	2				2				
25/Feb	63	368819	6184938	10	55	47.65	125	5.54	3		1					2		
25/Feb	64	369440	6184734	10	55	47.55	125	4.94	1						1			
25/Feb	65	369818	6184778	10	55	47.58	125	4.58	3					3				
25/Feb	66	370182	6185064	10	55	47.74	125	4.24	16	6	1			7		2		1 set of twins
25/Feb	67	369692	6185097	10	55	47.75	125	4.71	4	2				2				
25/Feb	68	369867	6185352	10	55	47.89	125	4.55	2					1	1			
25/Feb	69	370293	6185618	10	55	48.04	125	4.15	1					1				
25/Feb	70	370296	6185376	10	55	47.91	125	4.14	3	1				1	1			
25/Feb	71	371135	6185463	10	55	47.97	125	3.34	1					1				
25/Feb	72	371618	6185541	10	55	48.02	125	2.88	2	1				1				

APPENDIX B. Continued.

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Ogden Creek to Nina Creek, continued.																		
25/Feb	73	371497	6185693	10	55	48.10	125	3.00	3	1				2				
25/Feb	74	371616	6185096	10	55	47.78	125	2.87	2						1	1		
25/Feb	75	371974	6184491	10	55	47.46	125	2.51	8	2				5	1			
25/Feb	76	372265	6184408	10	55	47.42	125	2.23	4	2				2				
25/Feb	77	372353	6184202	10	55	47.31	125	2.14	2	1				1				
25/Feb	78	372690	6184637	10	55	47.55	125	1.83	1					1				
25/Feb	79	373001	6184572	10	55	47.52	125	1.53	2							2		
25/Feb	80	372947	6184500	10	55	47.48	125	1.58	3					3				
25/Feb	81	373663	6184664	10	55	47.58	125	0.90	2						2			
25/Feb	82	373242	6184937	10	55	47.72	125	1.31	2					1	1			
25/Feb	83	373050	6185165	10	55	47.84	125	1.50	2	1				1				
25/Feb	84	373136	6185589	10	55	48.07	125	1.43	1						1			
25/Feb	85	373542	6185522	10	55	48.04	125	1.04	5	2				2	1			
25/Feb	86	374317	6184850	10	55	47.69	125	0.28	1					1				
25/Feb	87	374341	6185313	10	55	47.94	125	0.27	2	1				1				
25/Feb	88	374267	6186020	10	55	48.32	125	0.36	6					5			1	
25/Feb	89	373955	6186067	10	55	48.34	125	0.66	6	1				4	1			
25/Feb	90	373537	6185726	10	55	48.15	125	1.05	2					2				
25/Feb	91	374357	6186241	10	55	48.44	125	0.28	1						1			
25/Feb	92	375679	6185683	10	55	48.16	124	59.00	2					1	1			
25/Feb	93	376192	6185334	10	55	47.98	124	58.50	2					2				
25/Feb	94	376537	6185714	10	55	48.19	124	58.18	3					3				
25/Feb	95	375498	6185948	10	55	48.30	124	59.18	1					1				
25/Feb	96	374916	6186039	10	55	48.34	124	59.74	2	1				1				
25/Feb	97	376685	6186137	10	55	48.42	124	58.05	3	1				2				
25/Feb	98	377807	6186643	10	55	48.71	124	56.99	2					1	1			
25/Feb	99	377976	6186713	10	55	48.75	124	56.83	1					1				
25/Feb	100	377534	6186595	10	55	48.68	124	57.25	1					1				
25/Feb	101	378792	6186337	10	55	48.56	124	56.04	2	1				1				
25/Feb	102	379305	6187121	10	55	48.99	124	55.57	1					1				
25/Feb	103	380611	6186732	10	55	48.80	124	54.31	5					5				
25/Feb	104	380824	6186893	10	55	48.89	124	54.11	8	2		1		4	1			
25/Feb	105	380551	6187235	10	55	49.07	124	54.38	2	1				1				
25/Feb	106	379750	6187368	10	55	49.13	124	55.15	1					1				
25/Feb	107	379357	6187119	10	55	48.99	124	55.52	1					1				
25/Feb	108	379209	6186697	10	55	48.76	124	55.65	1						1			

APPENDIX B. Continued.

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Ogden Creek to Nina Creek, continued.																		
25/Feb	109	380049	6186469	10	55	48.65	124	54.84	3	1				1	1			
25/Feb	110	380710	6186544	10	55	48.70	124	54.21	3					3				
25/Feb	111	381125	6186829	10	55	48.86	124	53.82	3					3				
25/Feb	112	381342	6187102	10	55	49.01	124	53.62	1						1			
25/Feb	113	381606	6187225	10	55	49.08	124	53.37	3	1				2				
25/Feb	114	382080	6186970	10	55	48.95	124	52.91	2	1				1				
25/Feb	115	382566	6187551	10	55	49.27	124	52.46	1					1				
25/Feb	116	382331	6187372	10	55	49.17	124	52.68	1					1				
25/Feb	117	382738	6187324	10	55	49.15	124	52.29	1						1			
25/Feb	118	383530	6187636	10	55	49.33	124	51.54	2	1				1				
25/Feb	119	384700	6187253	10	55	49.14	124	50.41	1					1				
Omineca River - Nina Creek to creek west of Blue Lake.																		
25/Feb	120	385588	6186431	10	55	48.71	124	49.54	3	2				1				
25/Feb	121	386757	6186400	10	55	48.71	124	48.42	8	3				5				
25/Feb	122	387441	6186160	10	55	48.59	124	47.76	2	1				1				
25/Feb	123	387297	6186275	10	55	48.65	124	47.90	1					1				
25/Feb	124	387867	6186056	10	55	48.54	124	47.35	8	1				4	2	1		
25/Feb	125	387923	6186203	10	55	48.62	124	47.30	4	1				3				
25/Feb	126	387634	6185561	10	55	48.37	124	47.56	2	1				1				
25/Feb	127	386618	6185866	10	55	48.42	124	48.54	4			1		2	1			
25/Feb	128	387593	6185581	10	55	48.28	124	47.60	2							1	1	
25/Feb	129	388132	6185418	10	55	48.20	124	47.08	7	2				3	1	1		
25/Feb	130	388121	6185381	10	55	48.18	124	47.09	1							1		
25/Feb	131	389203	6185205	10	55	48.10	124	46.05	4	1				1		2		
25/Feb	132	388970	6185081	10	55	48.03	124	46.27	2					1		1		
25/Feb	133	389277	6184814	10	55	47.89	124	45.97	2					2				
25/Feb	134	389387	6185015	10	55	48.00	124	45.87	6				1	4	1			
25/Feb	135	389928	6185335	10	55	48.18	124	45.36	5	2				3				
25/Feb	136	390409	6184525	10	55	47.75	124	44.88	1						1			
25/Feb	137	390666	6184741	10	55	47.87	124	44.64	2	1				1				
25/Feb	138	391079	6184564	10	55	47.78	124	44.24	1							1		
25/Feb	139	391124	6184266	10	55	47.62	124	44.19	3	1				2				
25/Feb	140	403635	6183209	10	55	47.21	124	32.20	5	1				4				
25/Feb	141	392607	6183357	10	55	47.15	124	42.75	4	1				3				
25/Feb	142	394493	6182624	10	55	46.78	124	40.93	2	1				1				
25/Feb	143	394293	6183445	10	55	47.22	124	41.14	1					1				

APPENDIX B. Continued.

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Nina Creek to creek west of Blue Lake, continued.																		
25/Feb	144	395682	6183801	10	55	47.43	124	39.82	2					2				
25/Feb	145	396324	6183563	10	55	47.31	124	39.20	2					2				
25/Feb	146	396605	6186581	10	55	48.94	124	39.00	5					5				
25/Feb	147	397513	6184741	10	55	47.96	124	38.09	3	1				2				
25/Feb	148	396406	6183914	10	55	47.50	124	39.13	2	1				1				
26/Feb	149	398068	6186565	10	55	48.95	124	37.60	2							2		
26/Feb	150	397750	6186369	10	55	48.84	124	37.90	5					4	1			
26/Feb	151	398241	6186394	10	55	48.86	124	37.43	2	1				1				
26/Feb	152	398446	6186649	10	55	49.00	124	37.24	1					1				
26/Feb	153	398811	6186641	10	55	49.00	124	36.89	2	1				1				
26/Feb	154	399504	6186754	10	55	49.07	124	36.23	3					2	1			
26/Feb	155	399688	6187047	10	55	49.23	124	36.06	2					2				
26/Feb	156	400025	6187169	10	55	49.30	124	35.74	1					1				
26/Feb	157	400221	6187517	10	55	49.49	124	35.56	3	1				2				
26/Feb	158	400455	6187679	10	55	49.58	124	35.34	2					2				
26/Feb	159	401441	6191089	10	55	51.43	124	34.47	1					1				
26/Feb	160	401245	6191205	10	55	51.49	124	34.66	2	1				1				
Omineca River Total									**492**	**93**	**3**	**4**	**8**	**268**	**73**	**42**	**1**	

		UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Nation River - Nation Arm to the creek east of South Munro Creek																		
26/Feb	1	457222	6126535	10	55	17.12	123	40.41	2	1				1				
26/Feb	2	457030	6123069	10	55	15.25	123	40.56	2	1				1				
26/Feb	3	457236	6118114	10	55	12.58	123	40.32	1					1				
26/Feb	5	452435	6119480	10	55	13.29	123	44.86	1					1				
26/Feb	6	451344	6120549	10	55	13.86	123	45.90	1						1			
26/Feb	7	448906	6120521	10	55	13.83	123	48.20	3					2	1			
26/Feb	8	450291	6120190	10	55	13.66	123	46.89	1						1			
26/Feb	9	447434	6121595	10	55	14.40	123	49.60	2					1	1			
26/Feb	10	445970	6121446	10	55	14.31	123	50.98	4	1				3				
26/Feb	11	444271	6121244	10	55	14.19	123	52.58	1						1			

APPENDIX B. Continued.

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Nation River - from the creek east of South Munro Creek to Chuchi Lake																		
26/Feb	12	440347	6122650	10	55	14.92	123	56.30	2	1				1				
26/Feb	13	439554	6122827	10	55	15.01	123	57.05	2	1				1				
26/Feb	14	439870	6122656	10	55	14.92	123	56.75	7	1				3	3			
26/Feb	15	439710	6122584	10	55	14.88	123	56.90	2					1	1			
26/Feb	16	436716	6122960	10	55	15.06	123	59.73	5	1				3		1		
26/Feb	17	436428	6122834	10	55	14.99	124	0.00	2	1				1				
26/Feb	18	434575	6122212	10	55	14.64	124	1.74	1					1				
26/Feb	19	432827	6121514	30	55	14.25	124	3.38	2					1	1			
26/Feb	20	431917	6120953	10	55	13.94	124	4.23	1					1				
26/Feb	21	431347	6121147	10	55	14.04	124	4.77	2					2				
26/Feb	22	424193	6119390	10	55	13.03	124	11.49	3						2	1		
26/Feb	23	424290	6119481	10	55	13.08	124	11.40	1					1				
26/Feb	24	424008	6119096	10	55	12.87	124	11.66	1					1				
26/Feb	25	423706	6118805	10	55	12.71	124	11.94	1					1				
26/Feb	26	422683	6117969	10	55	12.25	124	12.89	6	1				3	2			
26/Feb	27	422344	6118012	10	55	12.27	124	13.21	2					1	1			
26/Feb	28	422353	6118476	10	55	12.52	124	13.21	1					1				
26/Feb	29	421761	6116186	10	55	11.28	124	13.73	4	1				2	1			
26/Feb	30	420780	6117743	10	55	12.11	124	14.68	2	1				1				
Nation River Total									**65**	**11**	**0**	**0**	**0**	**36**	**16**	**2**	**0**	

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Total	Classification Calf	Yearling M	Yearling F	Yearling Uncl	Ad F	Ad M	U Ad	Uncl.	Comments
Omineca River - Nina Creek to creek west of Blue Lake, continued.																		
Ospika River																		
26/Feb	1	432719	6239676	10	56	17.94	124	5.23	2					2				Sidehill
26/Feb	2	440457	6242640	10	56	19.60	123	57.77	3	1				1	1			Sidehill
26/Feb	3	441069	6242929	10	56	19.76	123	57.18	1						1			River
26/Feb	4	440618	6242360	10	56	19.45	123	57.61	1					1				Sidehill
26/Feb	5	439377	6241375	10	56	18.91	123	58.80	4					1	1	2		Sidehill
26/Feb	6	438111	6240856	10	56	18.62	124	0.02	2					1	1			Sidehill
26/Feb	7	436623	6239987	10	56	18.14	124	1.45	2	1				1				Sidehill
Ospika River Total									15	2	0	0	0	7	4	2	0	

APPENDIX B. Continued.

Moose Kill Sites Observed

Date	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Comments
Omineca River								
24/Feb	348820	6181894	10	55	45.66	125	24.56	betw. moose group 10 & 11
24/Feb	361334	6183723	10	55	46.87	125	12.66	betw. moose group 39 & 40
25/Feb	383855	6187702	10	55	49.37	124	51.23	betw. moose group 114 & 115
25/Feb	386206	6186508	10	55	48.76	124	48.95	betw. moose group 120 & 121
26/Feb	401604	6196875	10	55	54.55	124	34.44	betw. group 12 & water survey stn
Nation River								
26/Feb	448547	6120673	10	55	13.91	123	48.54	betw. moose group 8 & 9
Ospika River								
26/Feb	440864	6147704	10	56	28.43	123	56.13	betw. bridge #2 & water survey stn

Locations of Other Wildlife Observed

Date	Group	UTM Easting	UTM Northing	Z	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Classification[a] Total	TRSW	Total	COME
Nation River												
26/Feb	4	455562	6118223	10	55	12.63	123	41.90			1	1 F
26/Feb	31	481347	6116241	10	55	11.66	123	17.58			1	1 F
26/Feb	32	480413	6116059	10	55	11.56	123	18.46	14	7 Ad 7 Juv		
26/Feb	33	479955	6115709	10	55	11.37	123	18.89			1	1 F

[a] TRSW = Trumperter Swan; COME = Common Merganser